accompanied by a map on the scale of 1 : 1,000,000, constructed after that of M. Jagor ("Reise in den Philippinen") and by some views and geological sections. The volcanoes of the Taal district, the Majajai, the Monte Labo, and Sierra Corasi, the Ysarog, Buhi, and Mayon, or Albay, were visited by the author, and are shortly described. Among other interesting observations we notice the very steep slopes (32°) on which lava-floods may flow sometimes without being interrupted for distances of more than 300 feet, observed on the Mayon. The height of this last being 2,374 metres (7,787 feet), Dr. Drasche points out the error in the index of volcanoes, given in the late Mr. Poulett Scrope's work, where the height of the Mayon is given as 3,200 English feet. Another error of the Index is that an active volcano is reported to exist on "the little island Mindoro," whilst on this rather large island (250 square geographical miles) there are no volcanoes at all, neither active nor extinct.

IN a communication to the Vienna Academy on the nature of gas molecules, M. Boltzmann abandons the notion that they behave like aggregates of material points (the atoms). He considers that in estimating the impact action of the molecules, we may almost regard the whole aggregate, which we denote as an individual gas molecule, and which may consist of different substances, perhaps even ether atoms, as rigid. It is found that then the ratio of the heat-capacities of the gas must be 1⅔, when the gas molecules have ball-form. The ratio of the heat-capacities will be 1·4 if the molecules have the form of rigid bodies of rotation, but which are not balls; and 1⅓ if they are of any other form of rigid bodies. These numbers at least seem to agree so far with those found experimentally, that one cannot say that experiment furnishes a contradiction of the theory thus modified. It is further shown that the values experimentally got for the heat-capacity, under this view, are in satisfactory agreement with the heat-capacities of solid bodies. Of course the gas molecules cannot be absolutely rigid bodies; this is already disproved by spectral analysis, but it may be that the vibrations producing gas spectra are merely brief shiverings during the shock of two molecules, comparable to the sound perceived on the shock of two ivory balls.

THE current opinion as to the Ural range not bearing any traces of former glaciers, is now contradicted by M. Poliakoff. This explorer, who has had during the last ten years many opportunities of making a close acquaintance with glacial formations in Southern Finland, in the basin of Lake Onego, and on the Valdai plateau, reports that, while the lower parts of the Ural ridge are connected under large alluvial deposits, its upper parts, especially east of the water-parting, exhibit unmistakable morainic deposits with scratched boulders. The rocks bear also, sometimes, true glacial striae running from north-west to south-east, and certainly such striae would be found more numerous, were the localities more thoroughly explored than M. Poliakoff could do as he crossed the ridge on his way to the Obi. A lower secondary ridge, the last crossed by the highway before Ekaterinburg, exhibits also many *trainées* of immense boulders running in parallel directions, such as are found in Finland, Erthonia, and northern Russia. Further east, on the shores of the Obi (near to the mouth of the Irtysh), the lowest parts of the loose deposits, which are roughly stratified sands, contain a good deal of well-polished and striated boulders of glacial origin. These observations make it very desirable that the Ural were thoroughly explored by a geologist well acquainted with glacial formations.

THE Göttingen Academy announces the following subject for prize competition in the physical class till November, 1878:—The question what special actions (if such there be) breathing in pure oxygen gas of the ordinary density of atmospheric air has on the animal organism, has not hitherto been answered by researches with sufficient agreement. Further researches, therefore, are desired, both on homoiothermal and, as far as practicable, on poikilothermal animals; in these should be shown, quite specially, along with the phenomena externally observable in the animals, the nature of the change of blood and material (excretion of carbonic acid, nature of urine). In the view of certain data, the purity of the oxygen from all foreign matters occurring in its preparation must be carefully looked to, while a mixture of atmospheric nitrogen within narrow limits, hardly to be avoided, would not essentially vitiate the results. In the mathematical class of the same Academy, new researches are desired on the nature of the unpolarised light-ray, calculated to bring the ideas regarding natural light from any source, near to those which theory connects with the different kinds of polarised light.

WE have received the Fourth Report of the New Cross Microscopical and Natural History Society, which, we are glad to see, continues to prosper. It contains an address by the president, Dr. F. T. Taylor, on "Spontaneous Generation."

FROM the Seventh Annual Report of the Wolverhampton Free Library Committee, we are glad to learn that a Naturalists' and Archæological Department has been established in connection with that institution.

IN 1875 a Bedfordshire Natural History Society was formed, and it has just issued its first Abstract of Proceedings. It has made a very fair beginning both as to numbers and as to the quality of the papers read. We hope it will receive more encouragement from residents in the county than it appears to have done, and that it will work diligently at local natural history. One of the papers, accompanied by a map, is "On the Botanical Division of Bedfordshire," by Mr. W. Hillhouse, F.L.S.

AMONG the papers in the *Proceedings* of the Belfast Natural History and Philosophical Society for 1875-6, is one by Mr. J. J. Murphy on the Glacial Climate and the Polar Ice-cap. Mr. R. Lloyd Patterson has a concluding note on some of the swimming birds of Belfast Lough.

THE additions to the Zoological Society's Gardens during the past week include two Vervet Monkeys (*Cercopithecus lalandii*) from South Africa, presented by Mr. T. G. Butler; two Arctic Foxes (*Canis lagopus*) from the Arctic Regions, presented by Sir Thomas Erskine, Bart, F.Z.S.; a Ring-Necked Parrakeet (*Palæornis torquata*) from India, presented by Miss Smith; three Silky Marmosets (*Midas rosalia*) from Brazil, purchased.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 21, 1876.—"On the Rotation of the Plane of Polarisation of Light, by Reflection from the Pole of a Magnet," by George Francis Fitzgerald, M.A. Communicated by G. Johnstone Stoney, F.R.S.

At the last meeting of the British Association, the Rev. J. Ker described a delicate and very remarkable experiment, from which it appeared that when plane polarised light is reflected from the polished surface of the end of a powerful magnet, the plane of polarisation is rotated. Mr. Geo. F. Fitzgerald has recently communicated to the Royal Society an explanation of this curious phenomenon, of which the following is an abstract:—

It is known from Faraday's and Verdet's experiments that when plane polarised light is transmitted through transparent diamagnetic or ferro-magnetic media, while under the influence of a powerful magnet, the plane of polarisation will be rotated, so that the plane of polarisation of the emergent beam will differ from that of the incident light. This action is most powerful when the direction of transmission coincides with the direction of the streams of magnetic influence, and in general the rotation is in opposite directions in diamagnetic and in ferro-magnetic media. Now, if we regard the incident light as formed of the two circularly polarised beams which are equivalent to it, we learn from Faraday's and Verdet's experiments that one of these beams is retarded more than the other in passing through the medium, or, in other words, that they have different refractive indices. And of course if a powerful iron magnet were transparent, we might expect to find a much more powerful action of this kind upon transmitted light. Iron, however, is not transparent, so that the effect on transmitted light cannot be observed. But any effect which this difference between the refractive indices can produce upon *reflected* light may be made the subject of experiment, and Mr. Fitzgerald has shown that the observation made by Mr. Ker is an effect of this kind.

To show this, Mr. Fitzgerald splits the incident plane polarised light into its two equivalent beams of circularly polarised light. These circularly polarised beams are one right-handed and the other left-handed, and, before incidence, are equal in intensity to one another. If, however, their indices of refraction in the magnet are very different, as Faraday's and Verdet's experiments lead us to suppose, their intensities after reflection will be sensibly unequal, and their phases also will in general be unequally affected. Hence their united effect after reflection is to produce in general an elliptically-polarised beam, the major axis of which is inclined to the plane of original polarisation, thus producing that appearance of a slight change of the plane of polarisation which was observed by Mr. Ker.

Mr. Fitzgerald has repeated Mr. Ker's experiment, and ascertained that the reflected light is, in fact, elliptically polarised, as indicated by the theory. He has also found that when the polished pole of the magnet is gilt the observed effect disappears. This is a further confirmation of the theory, since gold is diamagnetic, and therefore too feeble to produce an appreciable effect, if the effect is due to the cause which Mr. Fitzgerald has pointed out.

January 11.—"On some Phenomena connected with Vision," by B. Thompson Lowne, F.R.C.S., Arris and Gale Lecturer at the Royal College of Surgeons, &c., communicated by Prof. Stokes.

The author arrives at the conclusion that the intensities of the sensations produced by various illuminations of a white surface vary as the square roots of the intensities of illumination, by comparing the shadows, cast in Lambert's well-known experiment, with ruled shades, as those of engravings and wood-cuts, taking the amount of reserved white in the latter to indicate directly the intensities of the sensations produced by them. He considers the number of rods and cones stimulated on a given area of the retina as the measure of sensation, and proportional to the reserved white.

He further finds, by a repetition of the experiment of MM. Delbœuf and Plateau, that the grey ring seen on a rotating disc with a black or white sector, disappears when the sector is sufficiently narrow and the rotation sufficiently rapid, and that the rate of rotation necessary to produce this result with the same disc and sector varies as the square root of the intensity of the illumination of the disc.

Lastly, he proposes a modification of Fechner's formula, which only requires a change of Fechner's convention that the liminal increment of sensation is constant. The author proposes to consider that $\frac{\Delta x}{\sqrt{x}} \propto \Delta S$. The formula then becomes, in accordance with his experiments, $2K\int\frac{dx}{\sqrt{x}} = K\sqrt{x} = S$, which he regards as a physiological instead of a psychical one.

Anthropological Institute, January 23.—Col. Lane Fox, F.R.S., president, in the chair.—A new member was announced.—Col. Fox then read his report to the Anthropometric Committee of the British Association on the Second Royal Surrey Militia. The measurements, which comprised the profession, race, origin, age, height, weight, chest measurement, colour of hair and eyes, and strength of arm, &c., of 459 individuals afforded some interesting facts concerning what might be called a fairly representative number of men from within a radius of twenty miles round Guildford. It appeared that the colour of the hair was in 391 cases brown or dark brown, and in only two cases black, and in two cases red, one of the latter being Irish. As to eyes, 311 were grey, light blue, or blue, 133 brown or dark brown. Col. Fox proposed some modifications of the existing tests of strength of arm and sight; suggesting that in the first the test should be the same as in drawing a bow, neither hand being in any way supported, and the pull being from an object not fixed. From a table of twenty comparative cases the average of strength showed in the case of pulling from a fixed point, 165·55 lbs., while the same men pulling with the one hand against the other only 81·95 lbs. From the general results Col. Fox considered that the muscular strength, vital capacity, &c., of our reserve and regular forces would show very favourably in comparison with those of the ordinary population, and so dispose of some of the frequent alarms given by the "man in the street" as to the deterioration of our forces in physique.—Mr. Street, President of the Philological Society, read a very interesting paper on the development of language, and Mr. E. B. Tylor and the President and others took part in the discussion.—Papers by Mr. Knowles, of Ballycully, Ireland, on the classification of arrow-heads, and on the "Portstewart find," were also read, and numerous objects illustrating the papers were exhibited.

Physical Society, January 20.—Prof. G. C. Foster, president, in the chair.—The following candidate was elected a member of the Society: Mr. A. G. Greenhill, M.A.—Dr. Huggins exhibited an enlarged view of a photograph, half an inch in length, of the spectrum of the star α Lyræ, which he has recently taken in a manner similar to that in which the spectrum of Sirius has already been obtained. The first results were very unsatisfactory, in consequence of the clockwork being insufficient for maintaining the image of the star on the slit for a length of time. Mr. Grubb has, however, devised a secondary control apparatus, the employment of which renders it impossible for the error to exceed one-tenth of a second. In the spectroscope employed the prism was of Iceland spar, and the lenses of quartz. Dry plates were employed, and the necessary breadth was secured by slightly changing the position of the image instead of by the use of a cylindrical lens. Dr. Huggins has also been engaged in taking a series of photographs of the moon, and hopes to obtain some information in regard to the question of a lunar atmosphere of small extent. In the spectrum of α Lyræ a line occurs corresponding with H_1 in the solar spectrum, and several more refrangible ones which he is at present unable to explain.—Mr. Lockyer considered the results which Mr. Huggins is obtaining to be of extreme importance, and he pointed out how he hopes a large series of photographs of stellar spectra will afford valuable information in regard to the constitution of certain substances now supposed to be elementary, such as calcium. Some time ago he communicated a paper to the Royal Society on the spectrum of this metal, and he considers that it is not a simple substance, but that the H lines are due to two elementary substances of which it is composed, and this supposition is confirmed by the fact that in the photographs exhibited by Dr. Huggins only one of the H lines is present, that is, only one of the constituents of the metal calcium is present in the star α Lyræ.—Mr. W. C. Roberts read a paper on the artificial production of columnar structure. He gave an account of the several theories which have hitherto been given as accounting for this phenomenon and that of cross-jointing, as observed in the Giant's Causeway, and he dwelt specially on the views of Mr. R. Mallet and Prof. James Thomson. He found as the result of experiment, that when certain masses of clay and sand are heated to about 1300° C. they contract to about the same amount as a basalt does in passing from the molten to the solid state, and that beautiful columnar forms are produced. He had hoped, by accumulating a number of specimens, to have been able to establish a relation between the strains at the point of rupture and the dimensions of the hexagons, but in the small masses employed the strains were so numerous that it was impossible to apportion their influences. He had, however, obtained a number of specimens which possessed much interest.—Mr. Lecky referred to a very fine columnar cliff in the island of Bedness, in Valencia Harbour, which he has examined in the hope of finding cross-joints, but, although some breaks exist, there are none at all comparable to those in the north of Ireland.—Prof. Guthrie showed an arrangement he has recently devised, in the hope of making the mercurial as sensitive as the water barometer. It consists of an ordinary siphon barometer in which the two vertical tubes are united by means of a long uniform horizontal tube having a diameter considerably less than that of the main tubes. The instrument is filled in the same manner as the ordinary siphon barometer, except that a bubble of air or dilute acid is left in the narrow tube. For a given rise of pressure the absolute amount of mercury which passes from the shorter to the longer tube depends upon their diameters, and as these are great in comparison with the tube uniting them, the motion of the bubble will be considerable in comparison with that of the summit of the mercurial column. In the instrument exhibited, the horizontal tube was formed into a spiral, in order that the vertical tubes might be in close proximity. He then exhibited a number of thin india-rubber balloons, filled with water, which he has arranged with a view to illustrate the nature of jellies. When a jelly sets, it is assumed that the solid matter collects in the form of cells containing liquid, which burst on the application of heat. By weighing at intervals one of these india-rubber bags, he has found that evaporation takes place from its surface, thus with a bag weighing initially 749·4 grms., there was a loss of 0·95 grms. in the course of twenty-four hours. He is also examining a bag filled with salt water and immersed in water, in order to ascertain whether salt as well as water is capable of traversing the septum. Lastly Prof. Guthrie exhibited a large series of Chladni's rings, rendered permanent on cardboard by pressure, in contact with the plate which had been caused to vibrate, in a copying press. The sand and lycopodium were caused to adhere firmly by dilute gum.

GÖTTINGEN

Royal Academy of Sciences, December 2, 1876.—Remarks on some surfaces of a constant degree of curvature, by M. Enneper.—On the anatomy of Rhizocrinus lofotensis, by M. Ludwig.—On phenoxylic acid, by MM. Hübner and Buchka.

ROME

R. Accademia dei Lincei, December 3, 1876.—The following, among other papers, were read :—Mechanical experiments on the resistance of the principal metals used for fire-arms, by M. Rosset.—On the graduation of the Palmieri electrometer modified by Cantoni.—On Crookes's radiometer, by M. Marco.—Researches on picrotoxine, on cumosphenol, on action of chloride of acetile on santonic acid, on santonic chloride, on the chloride and the bromide corresponding to santonic acid, by M. Paterno, Cannizzaro, and others.—Petrographic studies on Latium, by M. Strüver.—Studies on the minerals of Latium, by the same.—On the muscular structure of the ventricle of the human heart, by M. Todaro.—The theoretic velocity of sound and the molecular velocity of gas, by M. Betti.—On fluoride of magnesium, by M. Cossa.—On the distribution of subterranean water in the district of Iglesias.—On the small motions of an entirely free rigid body, by M. Cerruti.—On the anatomy and physiology of the retina, by M. Boll.

PARIS

Academy of Sciences, January 22.—M. Peligot in the chair.—The following papers were read :—Craniology of the Negrito and Negrito-Papuan races, by MM. De Quatrefages and Hamy. The authors presented the fifth number of their *Crania Ethnica*. In this note they point out the differences between the two races named, and sketch their distribution. They are beginning the study of the Tasmanian type.—Memoir on electro-capillary actions; in which are treated :—(1) The depolarisation of the electrode and the electric effects produced on contact of the skin and various liquids; (2) Relations between electromotive forces, quantities of heat liberated during their production, and diffusive power, by M. Becquerel. Acids in contact with the skin take positive electricity, while alkalies take negative. With an alkaline liquid and the finger, *e.g.* the pores in the interior of the finger play the part of negative poles, those in the exterior of positive; the liquids within the finger tend to be deoxidised, those without to be oxidised. Soup and wine in the stomach being in contact with venous blood through the vessels, the exterior surface of the latter is the negative pole of electro-capillary couples, the positive poles being within. Thus the liquids of the stomach are reduced and the blood oxidised. M. Becquerel finds the greater hydration of acids has always a less influence on the electromotive force than on the amount of heat liberated. There does not seem to be any relation between diffusion and the production of electromotive force.—Researches on substituted eugenols, by M. Cahours.—Contemporaneous formation of zeoliths (chabasie, christianite) under the influence of thermal springs in the environs of Oran (Algeria), by M. Daubrée.—On the structure of the calcareous shells of eggs and the characters which may be inferred from it, by M. Gervais. This inquiry was suggested by the discovery of a few egg-like fragments in some beds of detritus at Rognac in Provence, by M. Matheron. From comparison the author thinks these fossil eggs did not belong to a bird but to a reptile; the structure of the shell closely resembles that of certain Emydosaurions. And this reptile, if really M. Matheron's Hypselosaurus, as seems likely, had more resemblance to Chelonians than the few fragments of its skeleton found there would indicate.—Observations of eclipses of Jupiter's satellites at the Observatory of Toulouse, by M. Tisserand.—On the advantage there would be in replacing quinine by cinchonidine in treatment of intermittent fevers, by Mr. Weddell. Cinchonidine can be obtained at a third (or less) of the cost of quinine; its effect is as good, and some patients can take it more easily than quinine.—On the transmission of excitations in nerves of sensibility, by M. Bert. The end of the tail of a young rat was skinned, turned over and inserted in the back, and held there by sutures till union occurred. Eight months after, this "handle" was cut. On the dorsal stump being pinched the rat evidently felt pain. In this fragment, then (says M. Bert), the excitation of the sensitive nerves is propagated from the thick end to the thin, or the inverse direction to the normal. But this sensibility of the dorsal stump diminished from the second day and soon disappeared. The nerves, separated from their trophic centres, had degenerated. Perhaps after a longer interval the influence of new trophic centres might be sufficient, and sensibility would persist after section.—On the communication which must have existed, in historic epochs, between the chotts of Tunis and the Mediterranean, by M. Roudaire.—On the capacity of saturation of manganous acid, by M. Gorgeu.—On the normals which may be drawn to a given point in a conic, by M. Laguerre.—Note on a manometric apparatus, *à propos* of a recent communication of M. Cailletet, by MM. Mignon and Rouart. It consists of a metal reservoir containing a liquid, and a glass tube indicating movements of the liquid; the two parts are connected by a suitable joint.—Action of heat on quercite, by M. Prunier.—On the fermentation of urine—reply to M. Pasteur—by Dr. Bastian.—On the characters of the electric discharges of the torpedo, by M. Marey. He shows that the voluntary discharge of the fish is formed of the addition of a series of successive currents, and resembles, in complexity, muscular contraction, which consists of a series of shocks, the effects of which combine to produce the contraction.—On the return of contractility in a muscle, where this property has disappeared in consequence of strong induction currents, by M. Carlet. The contractility returns while the muscle is subjected to weaker currents.—On the physiological and therapeutical properties of glycerine, by M. Catillon.—On the nidification of the Aye Aye, by MM. Milne-Edwards and Grandidier. In this it approaches the lowest order of Lemurians. The higher carry their young attached to their back or to their breast.—On the modification of the floral envelopes of Gramineæ, according to the sex of their flowers, by M. Fournier.—On the theory of ventilation, by M. Chaumont. A change of 1 per cent. in the moisture produces as much effect on sensation as 2·32° C.—On seven favourable cases of transfusion of defibrinated blood, by Dr. Ladislas de Bellina.

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